Statement by

Dr. Roy Schwitters

S.W. Richardson Professor of Physics
The University of Texas at Austin
and
Chair, JASON Steering Committee

Submitted to the

Committee on Armed Services
United States Senate

New START Treaty Hearing

July 15, 2010

Mr. Chairman and members of the Committee:

I appreciate this opportunity to discuss with you the findings and recommendations of the 2009 JASON report on the NNSA Lifetime Extension Program (LEP). The impetus for our study was a request from the House Subcommittee on Strategic Forces to the NNSA Administrator for a technical review of LEP strategies for maintaining the U.S. nuclear deterrent "analogous to" the 2007 JASON review of the RRW program.

In brief, our study found (and I quote): "*no evidence that accumulation of changes incurred from aging and LEPs have increased risk to certification of today's deployed nuclear warheads*" and that "*lifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence, by using approaches similar to those employed in LEPs to date*."

Our main conclusion that the aging US nuclear weapons stockpile can be maintained through LEPs without explosive nuclear testing fundamentally depends on the knowledge and experience gained from our nation's substantial post-cold-war investment in science-based stockpile stewardship, notably through advanced simulation tools, major new experimental facilities, the discipline of quantification of margins and uncertainties (QMU), and excellent work by scientists and engineers in the nuclear weapons program. But the future credibility of our nuclear deterrent faces technical risks and challenges, which we address in the report.

As mentioned, the LEP study followed on our review of the Reliable Replacement Warhead (RRW), which was part of a series of JASON studies going back several years sponsored by NNSA that also included assessments of pit lifetimes, verification and validation of nuclear weapons simulation codes, and the physics of boost. In all of these studies, members of JASON were provided excellent cooperation and access to laboratory technical expertise on a continuing basis.

NNSA specified its definitions of "refurbishment", "warhead component reuse", and "warhead replacement" in the study charge. We consider this terminology to be convenient shorthand for the type of LEP under consideration, but it is not indicative of the certification challenges facing life-extension of any particular weapon type—it implicitly assumes a clear distinction exists between the options, where, in fact, the reality is more complicated. For example, the currently ongoing W76-1 LEP mainly involves component refurbishment, but includes significant component reuse and replacement.

In any specific LEP, it is critical to assess each modification to the warhead on the basis of its effect on our confidence to certify the modified weapon for deployment without benefit of underground explosive tests in accord with US national policy. The benchmarks for assessing proposed modifications are:

- Existence of data from previous underground tests (UGT) or non-nuclear performance trials, which can be compared to predicted performance characteristics of the modified system,

- Scientific understanding of relevant phenomena, which provides guidance for comparing predictions with experiment and for estimating uncertainties,
- Results of non-nuclear experiments, which assist in validating nuclear simulations, improving scientific understanding, and qualifying non-nuclear systems.

We used these criteria to assess certification challenges of past, ongoing and planned LEPs on a case-by-case basis for all current stockpile systems.

Considerable attention was given to assessing risk that might be associated with "accumulation of changes" during the lifetime of a warhead. We identify four types of changes that can take place following the underground tests of a currently stockpiled weapon: 1) component aging, 2) differences between tested devices and stockpile warheads, including the differences introduced at the time of manufacture and differences introduced when LEPs (and ALTs) were performed, 3) variations among production units, and 4) changes in understanding of actual performance characteristics compared to original design expectations. The different categories of changes call for different responses.

In making stockpile assessments, it is important to compare the estimated value of the performance margin (M) to its associated uncertainty (U) through the ratio M/U; short of a predictive theory of weapons performance, a particular value of M without reference to U is not meaningful. Indeed, comparing M to U is the essence of what is meant by QMU and forms the basis of our (understated) finding: *Quantification of Margins and Uncertainties (QMU) provides a suitable framework for assessment and certification*. Producing new weapons systems with increased margin is a possible mitigation strategy should M/U fall below levels considered adequate as long as the corresponding uncertainty doesn't grow in equal or greater proportion. These considerations—documented in our report—support our first two findings I stated at the outset.

Our first two recommendations are:

- *Determine the full potential of refurbishment, as exemplified by LEPs executed to date, for maintaining or improving the legacy stockpile.*
- *Quantify potential benefits and challenges of LEP strategies that may require reuse and replacement, to prepare for the possibility of future requirements such as reduced yield or enhanced surety*.

This proposed LEP strategy seeks to leverage to the extent possible the investments already made in the program, especially in the knowledge of and experience with certifying weapons already in the stockpile.

There is broad agreement across the nuclear weapons community, JASON, and various review bodies that stockpile surveillance and retention/renewal of key science, technology, engineering, and production facilities and manpower are areas of critical importance to stockpile stewardship needing attention now. Secretary Chu testified to this Committee on June 17 that "the New START Treaty contains no

limitations that would constrain our warhead life extension program options, or the work to assess and correct any potential future warhead issue." This commitment to future science-based stockpile stewardship is critical to maintaining confidence in our nuclear deterrent.

I would like to comment on reactions to our LEP report and its executive summary, which was released publicly by NNSA in November 2009. The classified report details our assessments of the certification challenges associated with LEP strategies for all the systems in the enduring stockpile; the executive summary provides verbatim the complete list of findings and recommendations contained in the classified report. As to comments made by the laboratory directors in letters sent to Ranking Member Turner of the House Subcommittee on Strategic Forces earlier this year, I hope I have made clear that we do *not* propose a refurbishment-only strategy for future LEPs.

Regarding Director Anastasio's suggested strategy of "preemptively increasing margins", we offer two cautionary observations: 1) many past stockpile issues would not be addressed by additional margin, and 2) uncertainty is just as important as margin in establishing confidence. Director Miller's letter raises the concern over additional risk from "accumulation over time of small changes" for which JASON found no objective evidence, after careful study of the details. We note that: 1) changes induced from component aging can be erased by a LEP, and 2) changes introduced by LEPs are carefully chosen and assessed—they are not random—so that each LEP to date has produced a warhead with higher confidence factors than the original. Former director Hunter correctly points out that the JASON study focused on certification of nuclear components for which full performance testing is not possible; we agree that non-nuclear components can be substituted with greater flexibility as long as they are thoroughly tested.

We were concerned that some of the commentary on our work implied an inconsistency between the classified report and its unclassified executive summary. We discussed these concerns with Administrator D'Agostino in April. Subsequently, NNSA forwarded to its staff and laboratory leadership a statement that concludes:

> "NNSA has reviewed the JASON LEP report including the question of consistency between the unclassified executive summary of the report and the full classified version of the report JASON submitted to us. The two documents are consistent. Both versions support NNSA's commitment to maintaining the safety, security, and reliability of the nation's nuclear weapons stockpile under the terms of the (Nuclear Posture Review)."

JASON considers it a privilege to have the opportunity to examine important technical aspects of the nation's nuclear weapons program. A healthy technical give-and-take between knowledgeable people is crucial to the future of science-based stockpile stewardship.

I shall be pleased to answer any questions you have.

Background Information:

I am a professor of physics at The University of Texas at Austin and a member of the JASON study group. I have participated in all the recent JASON studies related to stockpile stewardship.

JASON comprises mainly university researchers—scientists and engineers—who conduct studies on technical issues related to national security for agencies of the U.S. government. Currently, I chair the JASON steering committee and, as such, am the public spokesman for JASON. The steering committee is the executive body of JASON; among other functions, it is responsible for selecting study leaders and approving the terms-and-conditions for all studies.

Professors Marvin Adams of Texas A&M University and Dan Meiron of Caltech led the 2009 LEP study and have briefed the classified report to congressional staff, NNSA staff, interagency officials, and weapons lab scientists and engineers. Three active nuclear weapons scientists from the labs joined us as expert consultants on the LEP study—they provided essential knowledge and insight, but JASON's findings and recommendations are, of course, solely our responsibility.